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National
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Program

# WORKSHOP ON FASTENER TEST METHODS

# PART I

S. Wayne Stiefel

NISTIR 4817

U.S. Department of Commerce
Technology Administration
National Institute of Standards
and Technology

NIST

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NISTIR 4817

# National Voluntary Laboratory Accreditation Program

# WORKSHOP ON FASTENER TEST METHODS

# PART I

S. Wayne Stiefel

April 1992

**U.S. Department of Commerce**
Barbara Hackman Franklin, Secretary

Technology Administration
Robert M. White, Under Secretary for Technology

National Institute of Standards and Technology
John W. Lyons, Director

# FOREWARD

Public Law 101-592, "The Fastener Quality Act," requires the establishment of an accreditation program for laboratories that test certain fasteners. The Act provides for the use of National Institute of Standards and Technology (NIST) procedures followed by the National Voluntary Laboratory Accreditation Program (NVLAP). In accordance with procedures a notice was published in the *Federal Register* inviting interested parties to provide a list of test methods to be included in the accreditation program. A public workshop was held at NIST in Gaithersburg, MD on April 22, 1991, to discuss the test method list.

Part I of this report (NISTIR 4817) summarizes the workshop presentations and the test method categories submitted in response to the notice published in the *Federal Register*. Part II of this report (NISTIR 4818) contains the appendices: (1) the notice published in the *Federal Register*; (2) detailed presentations by NIST and response to audience questions; (3) detailed presentations by public participants and response to audience questions; (4) the text of an open discussion session which followed the formal presentations; (5) a compilation of the test method lists; and (6) a list of the workshop presenters and attendees.

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# 1. EXECUTIVE SUMMARY

## The Fastener Quality Act

The President signed the Fastener Quality Act (FQA), Public Law 101-592, on November 16, 1990. The intent of the Act is to increase fastener quality and reduce the danger of fastener failure. It requires that certain fasteners sold in commerce conform to the specifications to which they are represented to be manufactured, provides for accreditation of laboratories engaged in fastener testing, and requires inspection, testing and certification in accordance with standardized methods.

The Act requires the Secretary of Commerce, acting through the Director of the National Institute of Standards and Technology (NIST), to establish a laboratory accreditation program for fastener testing laboratories under the procedures of the National Voluntary Laboratory Accreditation Program (NVLAP). Qualifying laboratories will be granted accreditation which attests to their competence to perform tests on fasteners according to designated standard test methods. Laboratories will be able to seek accreditation, based on their unique capabilities, by selecting from a predetermined and diverse list of test methods. The list of test methods will be classified by technical category. Potential categories include, but are not limited to: chemical, dimensional, mechanical, metallurgical and nondestructive testing. Specific requirements and criteria are being established for determining laboratory qualifications for accreditation following prescribed NVLAP procedures. Criteria address quality systems, staff, facilities and equipment, calibrations, test methods and procedures, manuals, records, and test reports.

## The Workshop

A notice was published in the *Federal Register*, March 22, 1991, announcing an April 22, 1991 workshop at NIST to provide interested parties an opportunity to discuss fastener specifications and to participate in the selection of test methods to be included in the accreditation program. Presentations at the workshop and test method lists submitted in response to the *Federal Register* notice contributed to a successful workshop. Many interested groups (both public and private) were involved, including manufacturers, standards organizations, instrument manufacturers, distributors and importers. The presentations and summary statistics for the lists are included in this report. The workshop presentations and lists of test methods will be used in determining an initial list of test methods that will be offered for accreditation. The NVLAP procedures provide for adding test methods to the list as may be found necessary.

In addition to the NIST representatives, ten speakers made presentations to the workshop attendees. A list of the registered attendees is provided as Appendix F.[1]

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[1]See Part II of this report (NISTIR 4818) for the appendices.

## Conclusions

1. The workshop presentations, discussion and test method lists submitted provided a valuable source of information to accomplish the purpose of the workshop - establishing a list of test methods to be offered for accreditation. This information will be used to develop the accreditation program for each category of fastener testing. The categories of fastener testing will include mechanical and physical, chemical analysis, dimensional inspection, metallographic analysis, and nondestructive inspection.

2. Other topics, not related to the development of a test method list, were addressed by the participants to the workshop. This information will be taken into account as the laboratory accreditation program is developed and as the implementing regulations go through the shaping process.

## Future Actions

1. Critical elements, which will be used to evaluate the competency of fastener testing laboratories, will be developed by NVLAP in each category of testing or inspection. Critical elements will be derived through a detailed evaluation of the needs prescribed by a test method.

2. Proficiency testing in each category of inspection or testing will also be addressed by NVLAP. Proficiency testing will provide a mechanism for comparison of interlaboratory test data.

3. Proficiency testing requirements and critical elements will be incorporated with other accreditation requirements into the NVLAP Fastener Handbook and assessor checklists.

4. A second workshop will be held to discuss the contents of the Fastener Handbook. The Handbook will describe all the laboratory accreditation requirements.

# 2. INTRODUCTION

**The Fastener Quality Act**

The Fastener Quality Act:

- requires that certain fasteners sold in commerce conform to the specifications to which they are represented to be manufactured
- provides for accreditation of laboratories engaged in fastener testing; and
- requires inspection, testing and certification in accordance with standardized methods.[2]

The Act requires the Secretary of Commerce, acting through the Director of NIST, to establish a laboratory accreditation program for fastener testing laboratories using the procedures of the National Voluntary Laboratory Accreditation Program (NVLAP). The accreditation program will include test methods which are required by fastener specification or standards covered by the Act.

**Purpose of the Workshop**

In accordance with NVLAP Procedures, a notice was published in the *Federal Register* requesting public input in establishing the accreditation program. To enable consideration of specific needs, submitters were requested to provide in writing: a list of the test methods with the related fastener specifications being used to test fasteners (as defined in the *Federal Register*). This information will be used in developing the assessment tools and Fastener Handbook which presents all accreditation requirements and evaluation criteria used by NVLAP in assessing laboratory competence. In conjunction with the written submissions, the public was invited to a public workshop at NIST to discuss the fastener specifications and test methods.

The purpose of the workshop was to provide all interested persons with the opportunity to:

- discuss fastener specifications, and

- participate in the development of a test method list for use in establishing some of the technical criteria for evaluation and accreditation of laboratories.[3]

**Workshop Agenda**

The agenda for the workshop (Figure 2) was organized to satisfy the purpose as stated in the *Federal Register*. NIST staff opened the workshop describing the process for developing a laboratory accreditation program . The Deputy Chief Counsel for NIST made some remarks concerning

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[2] Federal Register Notice, Vol.56, No. 56, Friday, March 22, 1991 (See Figure 1)

[3] Ibid

Laboratories which apply for accreditation must pay all necessary fees and meet all program requirements prior to initial accreditation. The accreditation will be issued for a one year period, renewable annually. The on-site assessment will be performed biennially. Proficiency testing will be conducted annually.

Dated: March 19, 1991.

John W. Lyons,

*Director.*

[FR Doc. 91-6902 Filed 3-21-91; 8:45 am]

BILLING CODE 3510-13-M

## National Institute of Standards and Technology

### National Voluntary Laboratory Accreditation Program (NVLAP)

**AGENCY:** National Institute of Standards and Technology, Department of Commerce.

**ACTION:** Notice of public workshop.

**SUMMARY:** The National Institute of Standards and Technology (NIST) will host a public workshop on April 22, 1991, to provide interested parties with the opportunity to participate in a discussion of test methods and related specifications (consensus standards) to be used in an accreditation program for laboratories engaged in the testing of fasteners covered by the Fastener Quality Act of 1990 (Public Law 101-592).

**DATES:** The workshop will be held on April 22, 1991 from 9 a.m. to 4 p.m. Those who wish to contribute lists of specific test methods and related technical information for discussion at the meeting are asked to submit their material in writing on or before April 15, 1991 to Nancy M. Trahey, Chief, Laboratory Accreditation Program, National Institute of Standards and Technology, Building 411, room A124, Gaithersburg, MD 20899, (301) 975-4016, FX (301) 975-3839.

**PLACE:** The workshop will be held at the National Institute of Standards and Technology, Green Auditorium (seating capacity—300 persons), Gaithersburg, Maryland.

**SUPPLEMENTARY INFORMATION:** The Fastener Quality Act of 1990 (Pub. L. 101-592) requires that certain fasteners sold in commerce conform to the specifications to which they are represented to be manufactured, to provide for accreditation of laboratories engaged in fastener testing, to require inspection, testing and certification, in accordance with standardized methods, of fasteners used in critical applications to increase fastener quality and reduce the danger of fastener failure, and other purposes. In the Act, a fasteners is defined in section 3(5) as: (A) A—(i) Screw, nut, bolt or stud having internal or external threads, or (ii) a load indicating washer, with a nominal diameter of 5 millimeters or greater, in the case of such items described in metric terms, or ¼ inch or greater, in the case of such items described in terms of the English system of measurement, which contains any quantity of metal and is held out as meeting a standard or specification which requires through-hardening, (B) a screw, nut, bolt or stud having internal or external threads which bears a grade identification marking required by a standard or specification, (C) a washer to the extent that it is subject to a standard or specification applicable to a screw, nut, bolt, or stud described in subparagraph (B), or (D) any item within a category added by the Secretary (of Commerce) in accordance with section 4(b), except that such item does not include any screw, nut, bolt or stud that is produced and marked as ASTM A 307 Grade A.

Section 6 of the Act requires the Secretary of Commerce acting through the Director of NIST to establish a laboratory accreditation program for fastener testing laboratories under the procedures of the National Voluntary Laboratory Accreditation Program (NVLAP) (15 CFR part 7). To become accredited, a laboratory must submit an application, pay the required fees (to be determined) and demonstrate competence to perform specific tests in accordance with NVLAP criteria. Determination of competence includes review of quality systems, onsite laboratory assessments, and proficiency testing.

*Scope of fastener testing*—The accreditation program will include test methods which are required by fastener specifications or standards covered by the Act. Since fastener testing involves a wide range of expertise, several subfields of accreditation will be offered. Potential subfields include but are not limited to: chemical, dimensional, mechanical and metallurgical testing.

The following plans for the worship have been established:

1. *Purpose.* The workshop will provide all interested persons with the opportunity to discuss fastener specification and to participate in the development of a test method list for use in establishing some of the technical criteria for evaluation and accreditation of laboratories. Persons wishing to provide lists of test methods and related specifications they currently use, are asked to submit them to NVLAP in writing by the date indicated. All respondents to this notice will be placed on a mailing list.

2. *Procedure.* The workshp will be an informal meeting. The presiding NIST chairperson will allocate time for persons wishing to make presentations and for discussion of each issue to be addressed, and exercise such authority as may be necessary to insure the equitable and efficient conduct of the workshop and to proceed in an orderly manner.

3. *Provisions.* This workshp will be open to the public. However, to guarantee space at the workshop and to make arrangements for entrance into the NIST facility, persons making presentations or observing the proceedings, should write to the above address. Please include name, address, telephone and FAX numbers, organizational affiliation(s) and intent to make a presentation. Requests involving a presentation, should be received by NVLAP no later than April 8, 1991; requests to observe should be received no later than April 15.

**Documents in the Public Record**

A summary record of the meeting will be prepared and made available for inspection and copying in the NVLAP program office, Building 411, room A124, Gaithersburg, Maryland.

Dated: March 18, 1991.

John W. Lyons,

*Director.*

[FR Doc. 91-6877 Filed 3-21-91; 8:45 am]

BILLING CODE 3510-13-M

## National Oceanic and Atmospheric Administration

### Proposed Boundary Expansion for the Great Bay (New Hampshire) National Estuarine Research Reserve

**AGENCY:** Sanctuaries and Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

**ACTION:** Notice with request for comments.

**SUMMARY:** Notice is hereby given that the Sanctuaries and Reserves Division, Office of Ocean and Coastal Resource Management (OCRM), National Ocean Service (NOS), National Oceanic and Atmospheric Admiistration (NOAA), U.S. Department of Commerce is considering the State of New Hampshire's request to expand the

Figure 1

# AGENDA OF FASTENER LABORATORY ACCREDITATION WORKSHOP

National Institute of Standards and Technology
April 22, 1991

Welcome to NIST - Donald R. Johnson, Director Technology Services

Development of a Fastener Laboratory Accreditation Program and Purpose of the Workshop - S. Wayne Stiefel, Program Manager Laboratory Accreditation

Development of Technical Criteria for Laboratory Accreditation - Samuel R. Low, Mechanical Engineer, Metallurgy Division

Remarks of Michael R. Rubin, Deputy Chief Counsel for NIST

Public Comment - Moderator S. Wayne Stiefel

Harry S. Brenner, Chairman ASTM F-16 Fastener Committee and President, Almay Research and Testing Corporation, Los Angeles, CA

Steve Hengeli, Steve Hengeli & Associates, Lake Worth, FL

John W. Locke, President, American Association For Laboratory Accreditation, Gaithersburg, MD

Stanley P. Johnson, President, The Johnson Gage Company, Bloomfield, CT

Bruce Armstrong, U.S. Navy Gage & Standards Center, Pomona, CA

Charles Wilson, Director of Engineering, Industrial Fasteners Institute, Cleveland, OH

Jon R. Lewis, Sales Engineer, Fabrication Specialty Inc., Dallas, TX

Richard W. Kerr, President, Kerr Lakeside, Inc, Euclid, OH

William E. Perry, Consulting Partner, Miller, Canfield, Paddock & Stone, on behalf of the Taiwan Fastener Association

Gus Tirado, Government Affairs Analyst, Toyota Corporate Motor Services of North America, Washington, DC

Discussion and Wrap Up

Adjourn

**Figure 2**

implementing regulations and criminal and civil penalties for those who falsely claim that they are accredited for the purposes of the Act. The public presenters represented laboratories, users (both public and private), manufacturers, standards organizations, instrument manufacturers, distributors, and importers. A discussion period followed, during which each speaker responded to questions from the audience. An open forum followed the formal presentations to allow attendees to express their opinions.

**Report Organization**

This document follows the outline of the agenda. The appendices are in Part II of this report.

- Section 3 provides a welcome by Dr. Donald R. Johnson, Director, Technology Services and a summary of the presentations by the NIST staff. (Detailed presentations and response to audience questions are in Appendix B.)

- Section 4 provides a summary of presentations by the public participants. (Detailed presentations and response to audience questions are in Appendix C.) Appendix D provides the text of the open discussion period which followed the formal presentations.

- Section 5 contains summary statistics for the lists of test methods received in response to the notice published in the *Federal Register*.

- Section 6 is a discussion of the conclusions of the workshop and next steps required to develop an accreditation program.

# 3. SUMMARY OF PRESENTATIONS (NIST)

This section contains summaries of the presentations of the NIST staff. Except for the welcoming comments of Dr. Johnson, the full text of each presentation including response to audience questions and discussions are contained in Appendix B.

## 3.1. WELCOME TO NIST

Dr. Donald R. Johnson, Director, Technology Services welcomed the attendees to NIST. He stated that this first workshop on NIST's implementation of the Fastener Quality Act of 1990 provides an opportunity to learn and to gather information on test methods and inspection techniques that are currently used for different kinds of fasteners. NVLAP will use this information as the basis for the technical accreditation program for fastener-testing laboratories.

He noted that representatives from testing laboratories, manufacturers, users both from the private sector and from government, distributors of fasteners and importers are on the agenda and should give a good cross section of views on current tests and inspection techniques.

Dr. Johnson observed that the fastener legislation has stimulated more interest than any other area in which he has been involved for many years. Perhaps the focus of much of that interest has been the advisory committee, which is in the final stages of structuring. A public announcement on the membership of that advisory committee and the first meeting date will be announced within the next couple of days.

Dr. Johnson also commented on other aspects of this broad legislation and its implementation through public rule-making. The Department of Commerce is drafting a rule which will be published for comment in the *Federal Register*. The rule will integrate all issues involved in this legislation. It will tie together the accreditation of other accrediting organizations, recognition of foreign laboratories, legal enforcement, and, of course, the domestic laboratory accreditation program.

Dr. Johnson concluded his remarks by emphasizing that these topics - accreditation of accreditors and recognition of foreign labs, legal enforcement, etc. - will not be the subject of discussion today. Today, we are interested only in collecting information on test methods and inspection techniques.

## 3.2. DEVELOPMENT OF A FASTENER LABORATORY ACCREDITATION PROGRAM

S. Wayne Stiefel, Program Manager, National Voluntary Laboratory Accreditation Program (NVLAP) explained that the Fastener Quality Act requires that manufacturers of fasteners certify that their fasteners conform with the requirements of the fastener specifications and have undergone inspection and testing by accredited laboratories. Section Six of the Act requires the Secretary of Commerce, acting through

the Director of NIST, to establish the fastener laboratory accreditation program using the procedures of the National Voluntary Laboratory Accreditation Program (NVLAP).

Mr. Stiefel noted that there is a history at NIST of developing programs for accrediting laboratories. NVLAP, established in 1976, currently accredits laboratories in ten major areas of testing, and has accredited approximately twelve-hundred laboratories; fastener testing will be added. NVLAP offers accreditation for specific test methods. In its application, a laboratory selects its unique scope of accreditation. When accreditation is granted, the scope of accreditation lists the test methods that the laboratory has demonstrated competency to perform.

Mr. Stiefel described the main steps in establishing a laboratory accreditation program. An initial step involves defining the test methods to be included. Development of a list of test methods is the primary reason for this meeting. Additional steps include: analyzing the test methods to determine whether they should be offered individually or whether similar methods should be grouped into units of accreditation; defining the critical elements that will be used to assess a laboratory's competency; developing assessment checklists for use during on-site assessments; developing the proficiency testing scheme; seeking technical experts to be NVLAP assessors, and producing a Program Handbook.

Mr. Stiefel stated that the Fastener Quality Act has specific requirements with significant impact on fastener testing laboratories. Among them are the maintenance of records for at least ten years and specific information required for the test report - including a statement as to whether, based upon the representative sample of fasteners tested, the lot of fasteners conforms to the relevant specifications. This statement requires the laboratory to be knowledgeable about the specification's testing and sampling requirements as well as specific knowledge about the fastener lot.

Describing an operational program, Mr. Stiefel stated that an applicant laboratory's competence to perform fastener testing will be assessed based upon conformance to specific accreditation criteria. Accreditation is granted following successful completion of a process which includes review of quality documentation, an on-site assessment (every two years), resolution of deficiencies identified during the on-site assessment, participation in proficiency testing, technical evaluation, and administrative review. The accreditation is formalized through issuance of a Certificate of Accreditation and a Scope of Accreditation.

NVLAP pursues the objective of producing a system of improved laboratories all capable of producing equivalent results.

### 3.3. DEVELOPMENT OF TECHNICAL CRITERIA FOR LABORATORY ACCREDITATION

Samuel R. Low, Mechanical Engineer, Metallurgy Division, NIST described his support for the NVLAP program by providing technical input and by developing the assessment tools (critical elements and checklists) used by the technical experts conducting on-site assessment and evaluation of fastener testing laboratories. Initially, the fields of fastener testing have been categorized as mechanical and physical, chemical analysis, dimensional inspection, metallographic analysis, nondestructive inspection, and others.

Mr. Low provided an initial list of the publishers of fastener standards and specifications and asked the audience for advice on the addition or deletion of organizations from this list. The initial list included the: Aerospace Industries Association, American National Standards Institute, American Society of

Mechanical Engineers, American Society for Testing and Materials, Industrial Fastener Institute, International Organization for Standardization, Society of Automotive Engineers, Federal Specifications and Standards, and Military Specifications and Standards.

In looking at fastener related documents, Mr. Low has found three classifications: fastener specifications which set the requirements for fasteners, fastener test method standards which give a description of procedures for testing fasteners, and other test method standards which give procedures for testing but not specifically for fasteners. To determine how a fastener is tested requires starting with the fastener specification and tracking references to and between the other classifications.

Mr. Low described several approaches for establishing the units of accreditation: (1) by fastener specification, (2) by fastener test method standard as described by a specific organization, and (3) by a type of fastener test method including all organizations with similar procedures and requirements.

Mr. Low explained that the critical elements of a test method are those requirements and procedures which are essential for testing the fastener including: test equipment, fixtures, instruments, calibrations, reference standards, personnel training, etc. In addition to the critical elements derived from the test method documentation, NVLAP asks that the technical evaluation take into account special considerations or "engineering judgement."

Mr. Low also described the need to use these technical evaluations of the test methods to structure the Fastener Laboratory Accreditation Handbook and the checklists. The Handbook will be used by assessors and laboratories alike to prepare for assessment, and the checklists will be used by the assessors during on-site inspections.

Finally, Mr. Low described the design of proficiency testing which will require selecting test methods and fastener types, grade and sizes; determining the number of samples; evaluating the need for observation by assessors, and establishing a schedule for testing.

### 3.4. REMARKS BY THE DEPUTY CHIEF COUNCIL

Michael R. Rubin, Deputy Chief Counsel for NIST commented that he has been participating in the process of drafting the regulations that will implement the Fastener Quality Act. He emphasized that the Department of Commerce has a very strong team effort to draft these regulations.

Mr. Rubin, during remarks on the civil and criminal penalty provisions, pointed out that the statute has a variety of criminal and civil penalties attached to it. For this workshop, he focused on the implications of the law in terms of the accreditation programs, both in NVLAP and for the program that NIST will undertake for the purpose of approving other accreditation programs to accredit laboratories. Mr. Rubin warned laboratories and accreditors to be very cautious about how they hold themselves out to the public. Based on the language in the law and the regulations being drafted, a laboratory which holds itself out as accredited to test fasteners under the Act would be committing a criminal act if it has not been approved through one of the procedures in the regulations. Since the regulations will not be final for many months, no laboratories now fit that category. Similarly, any accreditation body that holds itself out as approved to accredit individual laboratories under the Fastener Quality Act would also be in violation of the Act until such time as that entity has been approved under the regulations.

# 4. SUMMARY OF PRESENTATIONS (PUBLIC PARTICIPANTS)

This section contains summaries of the presentations of the public speakers. The detail of the presentations including response to audience questions and discussions are contained in Appendix C.

### 4.1. Harry S. Brenner, Chairman ASTM F-16 Fastener Committee and President, Almay Research and Testing Corporation, Los Angeles, CA

Mr. Brenner stated that the Fastener Quality Act represents landmark legislation in providing consumer protection by assuring that critical fasteners in fact conform to established requirements. Especially for industrial and commercial fasteners, conformance testing is now federally mandated under this legislation.

In undertaking the required tests, several significant factors should be considered. A test - or test method - should be discriminating enough to accept good parts and to reject bad or sub-standard parts. The test method should leave no ambiguity, since "how" a test is conducted can often affect the results of the test.

Several major efforts have been pursued to develop standards and methods of testing fasteners in a uniform manner. ASTM Committee F-16 has developed and issued Specifications F606 and F606M, which define techniques and requirements for testing of threaded fasteners, washers, and rivets covered by ASTM Specifications included in ASTM Volume 15.08. Separately, the Department of Defense has developed and issued MIL-STD-1312, which covers over 30 test methods applicable to Military fasteners.

The fact that these two test method standards are in place and have been widely and successfully used by the Government and Industry warrants their consideration as the basis for testing procedures under the provisions of Public Law 101-592. Accordingly, Mr. Brenner recommended that they both be accepted and used, as applicable, for the testing and evaluation of critical fasteners.

### 4.2. Steve Hengeli, Steve Hengeli & Associates, Lake Worth, FL

Mr. Hengeli related his experiences at Jet Avion Corporation. As a commercial heat treater, they follow the manufacturing customers' purchase order requirements. The customer is relied upon to apply the correct and proper documentation to the order. Jet Avion also has a contract to retest flight hardware to verify that fasteners are within specification. At random, one hardness test, tensile test, micro examination and chemical analysis are performed. Of nearly 200 lots tested, two percent were found to be non-conforming. Results are submitted to NASA for action.

As a heat treater of customer parts, Mr. Hengeli pointed out that they can only hope that the manufacturer has properly addressed all quality considerations. In his opinion, the law falls short since it does not address the responsibility of suppliers of special services under subcontract, such as heat treating and plating. After these services the lot will have to be tested or retested, but only if someone

is having the service performed prior to resale. No controls are provided if a manufacturer decides to alter product he is assembling for his own applications and sale.

Mr. Hengeli recommended that the law be extended to cover users of fasteners such as: manufacturers, building contractors, repair stations, and overhaul shops, as well as auto repair shops. He suggested that they should be required to pass the laboratory accreditation requirements for documentation, lot control, and traceability of fasteners, to preclude loss during use and assembly. He further recommended, that all commercial heat treaters and platers be required to have a quality system that, as a minimum, would prevent their becoming inadvert conduits for the misuse of fasteners.

### 4.3. John W. Locke, President, American Association For Laboratory Accreditation, Gaithersburg, MD

Mr. Locke explained that the American Association for Laboratory Accreditation (A2LA) has been in existence since 1978 and is a nonprofit professional membership society. Currently, 284 laboratories are accredited, including 52 fastener testing laboratories. The fastener testing accreditation program began about two years ago with encouragement from the Defense Industrial Supply Center.

The general requirements for accreditation are based upon ISO Guide 25 with additional specific requirements, similar to those of NVLAP. The general requirements were developed through the International Laboratory Accreditation Conference. The fastener program includes over 100 tests and types of tests. Laboratories are not accredited for fastener testing alone; rather, accreditations are granted for mechanical testing or chemical testing, and fastener testing is included within that scope.

Mr. Locke recommended the newly revised ISO Guide 25-1990 for use by NVLAP in revising its procedures. Specific recommendations by Mr. Locke included expansion on: measurement traceability and calibration, handling of test items, subcontracting, outside support services and supplies and complaints.

### 4.4. Stanley P. Johnson, President, The Johnson Gage Company, Bloomfield, CT

Mr. Johnson outlined the dimensional requirements he feels are necessary to implement the Law. His presentation focused on means and methods for achieving the objective, through use of existing standards. His list of required specifications for screw thread dimensional conformance included: FED-STD-H28/6 *Gages and Gaging for Unified Screw Threads - UN and UNR Thread Forms*, FED-STD-H28/20 *Inspection Methods for Acceptability of UN, UNR, UNJ, M, and MJ Screw Threads*, ANSI/ASME B1.1 *Unified Inch Screw Threads (UN and UNR Thread Form*, ANSI/ASME B1.2 *Gages & Gaging for Unified Inch Screw Threads*, ANSI/ASME B1.3 *Screw Thread Gaging Systems For Dimensional Acceptability - Inch and Metric Screw Threads (UN, UNR, UNJ, M, and MJ)*, MIL-S-1222H *Studs, Bolts, Hex Cap Screws, Socket Head Cap Screws and Nuts*, MIL-S-7742 *Screw Threads, Standard, Optimum Selected Series:General Specification*, and MIL-S-8879 *Screw Threads, Controlled Radius Root with Increased Minor Diameter:General Specification*. According to Mr. Johnson, the capability to utilize these standards effectively will promote the proper measurement of fasteners and the success of the law.

A primary standard is FED-STD-H28, section 20, which covers the acceptability requirements. This standard together with ANSI/ASME B1.3M, a commercial standard, cover three levels of inspection: system 21, system 22, and system 23.

In Mr. Johnson's summary, he stated there is system 21, 22 and 23. System 22 covers 90-95 percent of the work load, with system 23 significantly less. He suggested the inspection requirements and methods be fashioned out of the ANSI/ASME B1.3M document which is working well in the field. His final recommendation was that all measurements for product dimensions must generate actual size readings. If actual numbers are not on the report, disputes about the validity of the certification will revolve around the equipment which was involved. System 21 and method A will not allow you to determine dimensional conformance.

### 4.5. Al Balogh, U.S. Navy Gage & Standards Center, Pomona, CA

Mr. Balogh explained that his organization's primary function is the interface gage program for the Naval Sea Systems Command. Interface control planning involves analysis of weapon system designs to determine if interfaces meet specification and design requirements. He provided examples of the safety considerations for having interfaces controlled. Safety critical is defined by DOD-STD-2101 for major and minor characteristics which apply to design. Critical is a safety consideration. Measure is an interchangeability consideration. Safety and interchangeability are the areas of concentration for the Navy Gage & Standards Center (NGSC).

Mr. Balogh stated, that in the design of thread gages and functional gages containing threaded features, the NGSC adhere to the following standards:

| | |
|---|---|
| ANSI/ASME B1.2 | *Gages and Gaging for Unified Inch Screw Threads* |
| MIL-STD-114C | *Gages, Plug, Thread 'GO' Class X* |
| MIL-STD-115B | *Gages, Plug, Thread 'NOT GO'* |
| MIL-STD-116B | *Gages, Ring, Thread 'GO' Class X* |
| MIL-STD-117B | *Gages, Ring, Thread 'NOT GO'* |
| MIL-STD-273 | *Gages, Plug, Thread Setting, Class W, for 'GO' Gages* |
| MIL-STD-274 | *Gages, Plug, Thread Setting, Class W, for 'NOT GO' Gages* |

NGSC also utilize the following standards as guidance during certification/calibration of thread elements:

| | |
|---|---|
| ANSI B1.1 | *Unified Inch Screw Threads (UN and UNR Thread Form)* |
| ANSI B1.3 | *Screw Thread Gaging Systems for Dimensional Acceptability* |
| ANSI B1.7 | *Nomenclature, Definitions, and Letters Symbols for Screw Threads* |
| ANSI B47.1 | *Gage Blanks* |
| ANSI B89.1.6 | *Measurement of Qualified Plain Internal Diameters for Use as Master Rings and Ring Gages* |
| ANSI B89.3.1 | *Measurement of Out-of-Roundness* |

Mr. Balogh provided a list of critical thread attributes and measurement methods for critical thread attributes (external and internal threads). He noted that this list is the minimal measurement requirement; measurement of other attributes may be required depending on the specific application.

### 4.6. Charles Wilson, Director of Engineering, Industrial Fasteners Institute, Cleveland, OH

Mr. Wilson recommended an Industrial Fastener Institute (IFI) Document, IFI-139, as the basis for defining the quality assurance requirements for a fastener testing laboratory. IFI-139 provides a minimal set of requirements for a fastener testing laboratory. It also covers: proficiency testing, laboratory quality system and quality manual, staff training and the sample test report.

Since the basis for fastener evaluation rests on evaluation of conformance to the requirements of standards, Mr. Wilson listed the fastener requirements and the corresponding standards to be validated as: dimensional (ASME/ANSI), mechanical (ASTM/SAE), metallurgical (ASTM/SAE), physical property (ASTM), visual (ASTM/ASME), and performance (SAE/IFI).

According to Mr. Wilson, dimensional inspection may be the most controversial area. Key dimensional characteristics which relate directly to the functioning of the part should be inspected and these key characteristics may be different from product to product. The IFI suggested that the ASME B18 Committee undertake a complete examination of ASME B18.18.2M *Inspection and Quality Assurance for High-Volume Machine Assembly Fasteners*. The examination would determine which characteristics are appropriate for measurement during final inspection, for use in the absence of existing published characteristics within a given standard.

When making final dimensional inspections, Mr. Wilson stated that the IFI recommends a distinction be made between manufacturers having verified in-process controls and manufacturers that do not. The Fastener Accreditation Program (FAP-1) run by ASME is a third party program that could be used to verify in process control.

Mr. Wilson suggested that there should be a minimum installed capability for laboratories testing fasteners. Laboratories should be able to measure fastener geometry, proofload, surface hardness, thread acceptability, tensile strength, decarburization/carburization, coating thickness, core hardness, and surface discontinuity. For each of these fastener characteristics Mr. Wilson provided the following list of necessary equipment including: dimensional (gage blocks, outside and inside micrometers, calipers, thread gaging), hardness (Rockwell, Vickers or Brinnel tester), tensile and proof (tensile tester), decarburization/carburization (microscopic, or micro-hardness), coating thickness and surface discontinuities (per specification - microscopic, magnetic, columetric).

### 4.7. Jon R. Lewis, Sales Engineer, Fabrication Specialty Inc., Dallas, TX

Mr. Lewis commented on the inadequacy of current certifications. He refered to a manufacturer's test report (MTR), stating that this manufacturer is one of the finest producers in the world and has state of the art equipment. However, the MTR leaves the following questions unanswered:

What are the dimensions made to?
How is the screw marked & what does the logo look like?
How was it manufactured? SAE J429 requires this size to be upset and roll threaded.
Was it tempered in excess of 800 deg?
What was their sampling plan?
Did it pass visual inspection SAE J1061 (as required in SAE J429)?

Mr. Lewis requested that the implementation of P.L. 101-592 mandate specifications for certain strength fasteners, containing: minimum certification criteria for that specification and a fill-in-the-blank type

checklist. If sample fasteners are sent to an independent laboratory, are we just going to hand them the specification and say "Read it?" Or are we going to tell them the test criteria? If a specification has the minimum criteria listed, then the laboratory can run down the list and perform the necessary test.

Mr. Lewis recommended that the industry adopt a standard form so that it is easy to search for the required information. Mr. Lewis presented sample forms using SAE J429A and ANSI B18.2.1, as examples.

What are the advantages of "form type" inspection reports?

The mandatory form would serve to police testing requirements and take away any economic reward for producing non-tested fasteners.

The form would be produced or approved by the specification authors thus giving the industry a professional interpretation and guidelines of testing requirements.

Anyone reading or using the form would have the benefit of a standard form, thus saving hours in having to revise an inspection report.

It would decrease inspection time.

It would increase faith in product, supplier and specification.

Insurance risk and exposure might be lessened because it would be clear to the user how the product has or has not been tested.

Mr. Lewis commented that what he is asking for is within the spirit of the P.L. 101-592. In sec. 5 (c) Laboratory report of testing ... The report, which shall be in a form (I want to add homogenous form) prescribed by the Secretary.....

**4.8.. Richard W. Kerr, President, Kerr Lakeside, Inc, Euclid, OH**

Mr. Kerr commented that Public Law 101-592 means that each lot of the various types of fasteners covered by this act must have a complete final inspection.

There are many different specifications for the various types of products included under this legislation. The most stringent of these specifications require: material conformance; dimensional conformance; strength conformance, which is usually a by-product of correct hardness, which is a by-product of proper heat treatment; and surface discontinuities conformance.

A laboratory and/or a combination of laboratories accredited under this law must perform the final inspections and testings required by the various specifications to confirm that the lot meets the standards. Some specifications include some sort of a final inspection plan but many do not. It is not possible to write a general inspection and testing plan that will include all of the various types of products covered by this law. For this reason, it is necessary that a final inspection and testing procedure be written for each and every type of fastener, SPECIFICATION BY SPECIFICATION.

All laboratories should be accredited, SPECIFICATION BY SPECIFICATION, rather than being accredited for a given type of inspection or testing procedure. Additionally, the accredited laboratory must have a current copy of every specification for which it is accredited. The Industrial Fastener Institute Handbook cannot serve as a source reference for these specifications.

Many problems will have to be addressed in order to comply with this law. Many specifications are very poorly written and are hard to understand or are just not accurate.

Section 7 (d) of the law reads, in part, "Any person who significantly alters a fastener." What is the difference between "significantly alter" a fastener and "alter" a fastener? Does a fastener to which a self-locking plastic element has been applied have to be re-tested? I have been advised by one such manufacturer that they heat the parts up to 400 deg F to apply this plastic part. Have these parts been altered by this process?

It is not going to be possible for the United States Government to enforce any fines or prison sentences if a foreign accredited laboratory approves inferior parts. They would not be subject to any laws of the United States of America. The only recourse is to have their accreditation withdrawn.

There should be some method to accept parts that are not completely to the specification, but would be very functional from a practical standpoint. For example, the diameter of a cup point on a socket set screw which is a thousandth or two oversize. This would not hurt anything whatsoever, but the part is not in accordance with the specification. I have no ideas as to how any procedure can be written for deviations, but I think it is something that should be addressed. Why should a lot of good functional fasteners have to be scrapped because they are slightly out of specification?

**4.9. William E. Perry, Consulting Partner, Miller, Canfield, Paddock & Stone, on behalf of the Taiwan Fastener Association**

Mr. Perry provided a summary of current activities in Taiwan. The Metals Industry Development Center, which is funded by the Government, has a laboratory testing all fasteners exported to the United States, pursuant to IFI Standards. The Bureau of Commercial Production Inspection and Quality is a government agency overseeing that laboratory.

Mr. Perry stated that the Taiwan Fastener Association supports NIST's consideration of the IFI statements when implementing the Fastener Quality Act. The Taiwan Fastener Association will provide NIST with additional information about the testing methods and specifications used in Taiwan.

In his final point, Mr Perry commented on the magnitude of the task ahead. NIST may certify foreign laboratories in every single country in the world that produces fasteners for export to the United States - China, Taiwan, Korea, Japan, Thailand, the EC. This diversity should be considered in coming up with the specifications and test methods implementing the Act. He noted that these laboratories will operate in many foreign languages, including Chinese.

**4.10. Gus Tirado, Government Affairs Analyst, Toyota Corporate Motor Services of North America, Washington, DC**

Mr. Tirado, speaking on behalf of Toyota Motor Corporation, stated agreement that events have demonstrated the need for the Fastener Quality Act (Public Law 101-592), but wishes to bring NIST's attention in this public workshop to the following points concerning Public Law 101-592 as NIST considers drafting proposals to implement its provisions.

Technical problems. Central to the Fastener Quality Act is the definition of a fastener and which fasteners are to be covered under this Act. The answer may seem obvious, but the scope of the Act's definition of a fastener could be interpreted broadly to include components such as a motor vehicles's engine block, which has internal threads and, of course, has a diameter greater than 5mm.

Also, all fasteners subject to the Act must bear a manufacturer's insignia to aid in tracing a fastener's origins. There will be many instances in which markings will be either impossible or impractical.

Applicability of Law. Long before the Fastener Quality Act was even drafted, many industries, including our own, have had in place strict and thorough parts development, evaluation, inspection, procurement, and shipping safeguards to prevent substandard components from slipping through. For industries such as ours, compliance with the Fastener Quality Act will only duplicate the safeguards already in place. Such duplication of effort will add nothing, except extra cost, which in the end we will have to pass on to the consumer. We ask then that consideration be given in the final regulation to those who can prove that their own in-house parts procurement and shipping practices would have an equal or greater effect as compliance with Public Law 101-592.

Fastener standards and testing. We wish to point out that Japanese industry uses Japan Industrial Standards (JIS) which correspond to ASTM and SAE standards that are widely used in the United States. Further, Toyota has its own internal standards for fasteners, as do other automobile manufacturers, such as Nissan Motor Corporation. We ask that compliance testing be permitted, upon approval from NIST or the Department of Commerce, of the standards of manufacturers, industrial associations or other parties which have their own fastener performance standards.

In general, we believe that the evaluation of fastener quality would best be served by allowing for a standards organization for a given industrial field to set the testing criteria.

Laboratory accreditation. Toyota requests that consideration be given to allowing the Japanese Government or JIS to give approval for laboratory accreditation, as well as allowing for a mechanism for individual manufacturers to apply for laboratory accreditation on their own.

## 5. SUMMARY STATISTICS FOR RECOMMENDED TEST METHODS

The March 22, 1991 notice in the *Federal Register* resulted in 27 lists (which included fastener specifications and recommended test methods). There were 76 fastener-related specifications and 211 test methods recommended (105 mechanical, 23 metallographic, 42 dimensional, 32 chemical and 9 nondestructive). The 27 organizations submitting lists have been classified as accreditor, laboratory, distributor, manufacturer, foreign manufacturer, private user, government user, standard organization, and importer. Appendix E contains a compilation of the 27 lists.

The recommended test methods will be reviewed to provide guidance in the determination of an initial list of test methods to be offered for accreditation. Additional evaluations of the technical requirements for fastener testing may extend or contract the list.

## 6. CONCLUSIONS AND FUTURE ACTIONS

### Conclusions

The workshop presentations, discussion and written submissions have provided a valuable source of information to accomplish the purpose of the workshop - establishing a list of test methods to be offered for accreditation. This information will be used to develop the accreditation program for each category of fastener testing. The categories of fastener testing will include mechanical and physical, chemical analysis, dimensional inspection, metallographic analysis, and nondestructive inspection.

Many other topics, not related to the development of a test method list, were addressed by the participants to the workshop. This information will be taken into account as the laboratory accreditation program is developed, and as the implementing regulations go through the shaping process.

### Future Actions

Critical elements, which will be used to evaluate the competency of fastener testing laboratories, will be developed by NVLAP in each category of testing or inspection. Critical elements are derived through a detailed evaluation of the demands dictated by a test method. Specific requirements and criteria are being established for determining laboratory qualifications for accreditation following prescribed NVLAP procedures. Criteria address quality systems, staff, facilities and equipment, calibrations, test methods and procedures, manuals, records, and test reports. NVLAP will also address proficiency testing in each category of inspection or testing. Proficiency testing will provide a mechanism for interlaboratory

comparison of test data. Proficiency testing requirements and critical elements will be incorporated together with other accreditation criteria into the NVLAP Fastener Handbook and assessor checklists.

The next NVLAP workshop will provide the public an opportunity to discuss the contents of the Fastener Handbook. The Handbook will describe all the accreditation requirements.

## 7. ACKNOWLEDGEMENTS

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The President signed the Fastener Quality Act(FQA), Public Law 101-592, on November 16, 1990. The intent of the Act is to increase fastener quality and reduce the danger of fastener failure. The Act requires the Secretary of Commerce, acting through the Director of the National Institute of Standards and Technology(NIST), to establish a laboratory accreditation program for fastener testing laboratories under the procedures of the National Voluntary Laboratory Accreditation Program(NVLAP).

A notice was published in the Federal Register March 22, 1991, announcing an April 22, 1991 workshop at NIST to provide interested parties an opportunity to participate in the development of a list of test methods to be included in the laboratory accreditation program. The workshop resulted in presentations and lists of fastener specifications and test methods submitted by laboratories, users (both public and private), manufacturers, standards organizations, instrument manufacturers, distributors and importers. The presentations and summary statistics for the lists are presented in this report. The lists have been categorized by fastener specification, and by type of fastener inspection or testing. The workshop results and lists of test methods will be used in the determiniation of an initial list of test methods to be offered for accreditation. Part I of this report (NISTIR 4817) summarizes the workshop presentations and the test method categories submitted in response to the notice published in the Federal Register. Part II of this report (NISTIR 4818) contains the appendices.

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